

retina and without any favorable change in the general condition, the improvement depending upon changes quite invisible to the naked eye.

I should like to make another observation to this effect, that within the past few years I remember to have seen a statement that an English observer in the out-patient department of one of the hospitals had examined all the cases of albuminuria admitted to that institution, and had found that in about sixty per cent. of the cases there was implication of the eye.

REMARKS ON PYOGENIC MICRO-ORGANISMS, WITH DEMONSTRATIONS AND EXPERIMENTS.

By H. KNAPP, M.D.,
NEW YORK.

DR. K. made some general remarks about the dependence of suppuration on certain kinds of micro-organisms, the pyogenic bacteria, of which pure cultures had been obtained during the last two years. He exhibited these bacteria in numerous test-tube specimens on agar-agar, further under the microscope, where also he showed microscopic slides of different tissues of the eye that had been infected with these germs. Then he showed two rabbits whose eyes he had operated on for cataract the day before, in the presence of members of the Society. Extraction had been made on the left eyes with clean instruments, on the right eyes with instruments contaminated with *staphylococcus pyogenes aureus*. The left eyes were free from secretion, the wound of the one in doubtful, of the other in good condition, whereas the right eyes discharged matter profusely, and were in a state of intense destructive inflammation. He then operated on two other rabbits, in the same way, before the Society. The four rabbits were exhibited again the next day and examined by the members of the Society. The right eyes in all were suppurating, the wounds of the left eyes in three of the rabbits were in good condition, in one of the first two

rabbits it was suppurating ; this eye had become infected from the right eye of the other rabbit. They had been kept in the same box, and Dr. Knapp found them with their heads in close contact.

Dr. K. said that he had made these demonstrations in order to draw the attention of the gentlemen to this new and important field of inquiry, and he would be happy to furnish cultures of these and other organisms to anybody who intended to make investigations in this department.

DISCUSSION.

DR. WEBSTER.—I was present yesterday when Dr. Knapp operated on the two rabbits which he has exhibited. He did not operate on any of the eyes with any care. As cataract extractions, all the operations were done very badly. In the left eyes especially, he squeezed out not only the lenses, but also considerable of the vitreous humor. He then put in a blunt hook and stirred it around and scraped in the region of the ciliary body. If a human eye had been operated on in that way I should have expected to have seen it in a condition of pan-ophthalmitis the next day. I so said at the time. I must say, if it had not been for the Doctor's assurance, I should have been much surprised at the condition of the eyes. This experiment shows in a striking manner the effects of inoculation on the right eyes of these rabbits.

DR. STRAWBRIDGE.—I would ask Dr. Knapp whether the result of these inoculations has shown anything as to the best method of cleansing instruments so as to protect against infection of this kind. Does he consider cleaning instruments with water and towel sufficient, or does he think that some extra means should be employed ?

DR. KNAPP.—In the institutions of Europe, they lay the instruments in antiseptic solutions which dull the edge. I took particular care to examine this point. An instrument is clean when all its surfaces are bright, shining and polished. I have made experiments on this point. I have dipped a knife in an infecting solution and washed it with water. It produced purulent inflammation. I have contaminated a knife in the same way, washed it with water, then wiped and polished it with a towel ; now it has produced no infection. Smooth instruments can be cleaned in this way, instruments that are

rough can not; for these we must use an antiseptic. In the Heidelberg surgical clinic I have been pleased to see that they do not lay smooth cutting instruments in antiseptic lotions. They cleanse them mechanically and have no infection from them. This is a manifest advantage, for when the edges are dull we are apt to make irregular sections, by more or less dragging and sawing. Instruments like forceps may be put in the antiseptic solution without disadvantage. Cataract knives are readily cleansed. Knives having a groove are more difficult to clean, and require particular care.

I think that these views are correct, and that in a short time they will carry the day and be the general practice. They are confirmed by the bacteriological experiments recently made. A knife is dipped into the infecting matter, and then cleaned with water and wiping. The blade is then dipped into all kinds of culture media, but nothing is produced.

The nutrient jellies are exceedingly sensitive to the action of micro-organisms. When there is the least quantity of microbes a growth will develop. If we find that no growth follows such an experiment, we have sufficient evidence that the instrument used was clean.

In the majority of our operations, it requires more than a minimum quantity of the infecting matter to produce suppuration. When blood or some liquid, for instance aqueous humor, flows out through the wound, large quantities of the infecting matter may be washed away and prove innocuous, but if anything is sucked in the reaction is very marked.

DR. NORRIS.—I would ask Dr. Knapp, how far his experiments show any inflammation apart from the pyogenic inflammation? Has he ever treated wounds with iodoform, carbolic acid, and other irritants, supposed to be anti-pyogenic? If so, is there any inflammation following such treatment, and how does it compare with the bacillus inflammation?

DR. KNAPP.—I have restricted my experiments to pure and infected wounds. In Paris and other places I have seen, however, that thick layers of iodoform were put on cataract wounds, and produced no inflammation.

The experiments can be varied in different directions, and the positive or negative answers can surely be expected to settle many a question of practical importance.

DR. FRYER.—There is one antiseptic lately come into use, which probably would not interfere with the edge of cutting instruments, that is hydro-naphthol. This has not been sufficiently long under observation to show how perfectly it

will sterilize instruments. The chances are that in strong solution it will.

It has also occurred to me that chloroform might perfectly sterilize instruments. I would ask Dr. Knapp if he has tried it?

DR. KNAPP.—I have had no experience with chloroform. The same was suggested of oil of eucalyptus, but it has fallen into oblivion.

DR. NOYES.—Does alcohol affect the edges of instruments?

DR. KNAPP.—I think that it does.

DR. AGNEW.—I feel sure that 95% alcohol will dull the edges of instruments.

DR. HUBBELL.—This subject of the infection of wounds has a very important bearing upon operations on the human eye, and Dr. Knapp is demonstrating that certain forms of bacteria, at least on lower animals, have a prejudicial effect. It seems to me that his experiments bear principally upon the condition of instruments. I would ask if there are not special conditions of the eye or its appendages which would favor infection of the wound after operation?

I am led to ask this question on account of the special interest I have taken in this subject in connection with a case which I recently treated. A man, aged sixty, had had a cataract operation on one eye ten years ago, which was an entire failure. He came to me in May last with the other eye cataractous, and otherwise in a bad condition. There was ectropion of the lower lid, due to excessive hypertrophy of the conjunctiva, complete obstruction of the nasal duct, and a constant discharge of pus from the lachrymal sac. The conjunctiva of the upper lid was also granular and much thickened, and a large amount of pus was constantly discharging from the eye. When I first saw the patient I had been reading Dr. Knapp's article in the Archives of Ophthalmology, upon the subject of infection of wounds of the eye, and his experience made me fearful of disastrous results in an operation in this case. But an operation was necessary in order to give the patient vision, and I concluded to extract, as a last resort. After cleansing and treating the eye as well as I could for a week, I performed an iridectomy, and in two weeks after this did the extraction. Notwithstanding there was a constant discharge of pus, the patient had no drawback after either operation, and he recovered with good vision.

The question arises in my mind, how much has the condition of the eye and its surroundings to do with this subject of bacterial infection. Here was a bad case, but we had no in-

fection. The only antiseptic used was a saturated solution of boracic acid. I would ask what conditions would be most likely to present these bacteria and lead to infection of operation wounds of the eye?

DR. KNAPP.—I think that chronic purulent dacryocystitis and certain forms of chronic, even mild conjunctivitis, furnish the most favorable soil for the bacteria. In operating on such cases, if the disease cannot be radically cured before, particular precautions should be taken, and cocaine should not be used. As I said before, it requires a certain quantity of the pathogenic bacteria to produce infection. I have pricked the cornea to one or two thirds of its depth and spread over it an emulsion of pathogenic bacteria. Only about one in every four or five punctures developed an abscess. The same thing is seen in daily practice. It is not every case of lachrymal or conjunctival disease that exhibits suppuration ~~after~~ extraction. In doubtful cases, it would be proper to examine the secretion of the lachrymal sac and the conjunctiva bacteriologically.

DR. ANDREWS.—As directly bearing on the last words of the speaker, I might say that in every inoculation of the cornea, the anterior chamber and the vitreous chamber with the pathogenic material, I have not failed to produce the result shown to-day. I have frequently pricked the cornea and introduced a living growth of the staphylococcus pyogenes aureus into the conjunctival sac. In three or four cases, I have seen the operation followed by perfect recovery without any suppuration or inflammation. The *mere contact* of the microbe with the wound is not always sufficient to produce suppuration, especially in the case of the cornea, because it is washed away by the tears. I have never once seen a failure where the material has been introduced into the wound and has remained a sufficient length of time, in contact with the wound surface.

In regard to the suggestion to clean instruments by wiping with a towel, this might be bad practice in a hospital, where the towels are apt to be contaminated. This might perhaps be obviated by using absorbent cotton.

For washing instruments, I use an aseptic fluid. I secure clean water and boil it for some time. When cold I use this for washing my instruments. *I think that the chief value of antiseptic fluids is that you have something which you are sure is clean.*